

Transient Stability Analysis with PowerWorld Simulator



T5: Transient Contingencies



2001 South First Street
Champaign, Illinois 61820
+1 (217) 384.6330

support@powerworld.com
<http://www.powerworld.com>

Transient Stability Analysis: PowerWorld's Design Goal



- Traditional transient stability
 - Create one set of events which define your transient stability simulation
 - Similar to having a tool to solve one power flow solution
- PowerWorld's Design Goal
 - Mimic the processing of Simulator's Contingency Analysis
 - Define multiple contingencies and process them all
 - This section will concentrate on defining a single transient contingency
- This leads to creating a new object in Simulator called a *Transient Contingency*
 - Similar to Contingency records except a different set of actions are available
 - Also timing inputs are important

Transient Contingencies

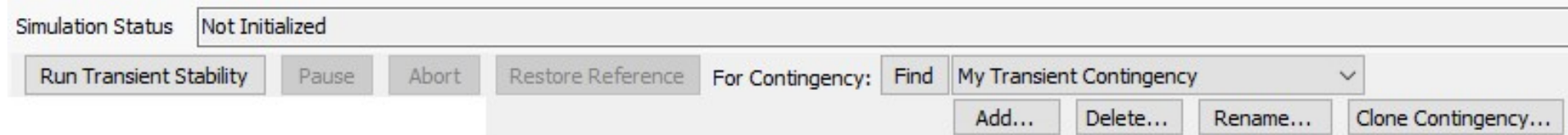


- Goal - to simulate a particular contingency and see if it causes any problems for the system
- A transient contingency will consist of one or more events
- One contingency might be the outage of a generator to gauge the response of the governors of the remaining generators
- Another contingency might simulate a bus fault, which has events to both initiate and clear the fault

Defining a Transient Contingency



- A new contingency will automatically be given an unused name starting with “My Transient Contingency”
- Several buttons for processing transient contingencies are normally available at the top of the dialog, regardless of the page
- More than one contingency may be specified



- Use Add, Delete, and Rename buttons to manage the transient contingencies
- Use the drop-down menu to choose the presently active contingency from a list of available contingencies

Transient Contingency



- Specify Start and End Time
- Specify Time Step (seconds or cycles)
 - Recommend either 0.5 cycles or 0.25 cycles
- Transient Contingencies have one or more Transient Contingency Elements to specify the events that occur during the simulation
 - Fault Bus
 - Open Line
 - Etc...

Events occur at specified times

A Transient Contingency with two Transient Contingency Elements

Transient Contingency Elements



- Insert Elements Button
 - Opens the Transient Stability Contingency Element Dialog
- Clear All Elements
 - Deletes all currently defined events
- Insert Apply and Clear Fault
 - Quickly apply/clear a fault by specifying both its fault time and its clearing time in one dialog
- Element Table
 - A case information display which lists all transient stability elements currently defined for the Transient Contingency
 - Clicking on an event and choosing “Show Dialog” option will open the Transient Stability Contingency Element Dialog

Transient Contingency Element Actions Types



- Bus
 - Apply Fault
 - Apply the specified fault type (Balanced 3 phase, Single Line to Ground, Line to Line, or Double Line to Ground)
 - Fault Across – (Solid, with Impedance and specifying PU Resistance and PU Reactance, or with Admittance specifying PU Conductance and PU Susceptance)
 - Clear Fault
- Generator
 - Open the generator.
 - Close the generator.
 - Ramp Values : Output , Exciter Setpoint (Vref), Governor Setpoint (Pref) Set Values
 - Set Value: Output , Exciter Setpoint (Vref), Governor Setpoint (Pref)
- Load
 - Open
 - Close
 - Set Values

Transient Contingency Element Actions Types



- Switched Shunt
 - Open
 - Close
- AC Line/Transformer
 - Apply Fault
 - Apply the specified fault type (Balanced 3 phase, Single Line to Ground, Line to Line, or Double Line to Ground)
 - Fault Across – (Solid, with Impedance and specifying PU Resistance and PU Reactance, or with Admittance specifying PU Conductance and PU Susceptance)
 - Percent Location
 - Clear Fault
 - Open : Both Ends, From End Only, To End Only, One Phase Open
 - Close : Both Ends, From End Only, To End Only
 - Bypass, and Not Bypass: intended for series capacitors
- DC Line
 - Open

Creating Transient Contingency Elements



- Click **Insert Elements**, or Choose **Records, Insert** → Opens the Transient Contingency Element Dialog
- Transient Contingency Elements involve specifying the following:
 - Object element is applied to
 - Time element occurs
 - Event Type
 - Parameters for element

Transient Stability Contingency Element Dialog

Description

Insert Save Delete

Object Type

- Branch/Transformer
- Bus
- Generator
- Load
- Switched Shunt
- DC Line
- Injection Group
- Line Shunt
- Simulation
- Transformer
- Area

Choose the Element

Sort by Name Number

Filter Advanced Branch

Use Area/Zone Filters Quick Define Remove

Search For Near Bus	Select Far Bus, CKT
1 (Bus 1) [16.50 kV]	1 (Bus 1) [16.50 kV] CKT 1
2 (Bus 2) [18.00 kV]	5 (Bus 5) [230.0 kV] CKT 1
3 (Bus 3) [13.80 kV]	6 (Bus 6) [230.0 kV] CKT 1
4 (Bus 4) [230.0 kV]	
5 (Bus 5) [230.0 kV]	
6 (Bus 6) [230.0 kV]	
7 (Bus 7) [230.0 kV]	
8 (Bus 8) [230.0 kV]	
9 (Bus 9) [230.0 kV]	

Time

Time (Seconds) 1.000000

Description

Type

- Apply Fault
- Clear Fault
- Open
- Close
- Bypass
- Not Bypass
- Set Values

Parameters

Fault Type Balanced 3 Phase

Fault Across Solid

Percent Location (near to far)

0.00

not used 0.00

not used 0.00

Calculate Effective Impedance from Sequence Networks

Self Clearing Fault

Comment:

OK Help Cancel

TS9Bus Example



- Open **TS9BusNoModels.pwb**
- With PowerWorld Simulator, a power flow case can be quickly transformed into a transient stability case
 - This requires the addition of at least one dynamic model
- We will now go through how to transform a power flow case into a transient stability case
- Add a dynamic generator model to an existing “no model” power flow case by:
 - In run mode, right-click on the generator symbol for bus 1, then select “Generator Information Dialog” from the local menu
 - This displays the Generator Information Dialog, select the “Stability” tab to view the transient stability models; none are initially defined.

Inserting a Model

- From the Generator Information Dialog, insert a GENSAL model (represents a salient pole machine)

The image shows two screenshots from a software application. The left screenshot is the 'Generator Information for Present' dialog box. It has several tabs: 'Power and Voltage Control', 'Costs', 'OPF', 'Faults', 'Owners, Area, etc.', 'Custom', and 'Stability'. The 'Machine Models' tab is selected, and the 'Insert' button is highlighted with a blue box and an orange arrow pointing to it. The text 'Click to insert a machine model' is written in blue to the left of the dialog. The right screenshot is the 'Model Type' dialog box, which is open to show a list of model types. The 'GENSAL' model is selected in the list, indicated by a blue highlight and an orange arrow. The text 'Choose GENSAL' is written in blue to the right of the dialog. At the bottom of the 'Model Type' dialog, the 'OK' button is highlighted with a blue box and an orange arrow, with the text 'Click "OK"' written in blue to the right.

Click to insert a machine model

Choose GENSAL

Click "OK"



Inserting a Model

- GENSAL Dialog for Bus 1 now looks like this-

GENSAL is the only machine model inserted for this generator, so it was automatically made active

If you add more models, you need to select which to make active

Generator Information for Present

Bus Number: 1 (Find By Number)

Bus Name: Bus1 (Find By Name)

ID: 1 (Find ...)

Area Name: 1 (1)

Labels: no labels

Generator MVA Base: 100.00

Status: Open Closed (View Bus Dialog)

Energized: NO (Offline) YES (Online)

Fuel Type: UN (Unknown) | [PW=0] [EPC=0]

Unit Type: UN (Unknown) | [PW=0] [EPC=0]

Power and Voltage Control Costs OPF Faults Owners, Area, etc. Custom Stability

Machine Models Exciters Governors Stabilizers Other Models Step-up Transformer Terminal and State

Insert Delete Gen MVA Base: 100.0 Show Block Diagram Create VCurve

Type: Active - GENSAL Active (only one may be active) Set to Defaults

Parameters:

H	3.00000	Tdop	7.00000
D	0.00000	Tdopp	0.04000
Ra	0.00000	Tqopp	0.05000
Xd	2.10000	S1	0.00000
Xq	0.50000	S12	0.00000
Xdp	0.20000	RComp	0.00000
Xdpp	0.18000	XComp	0.00000
Xl	0.15000		

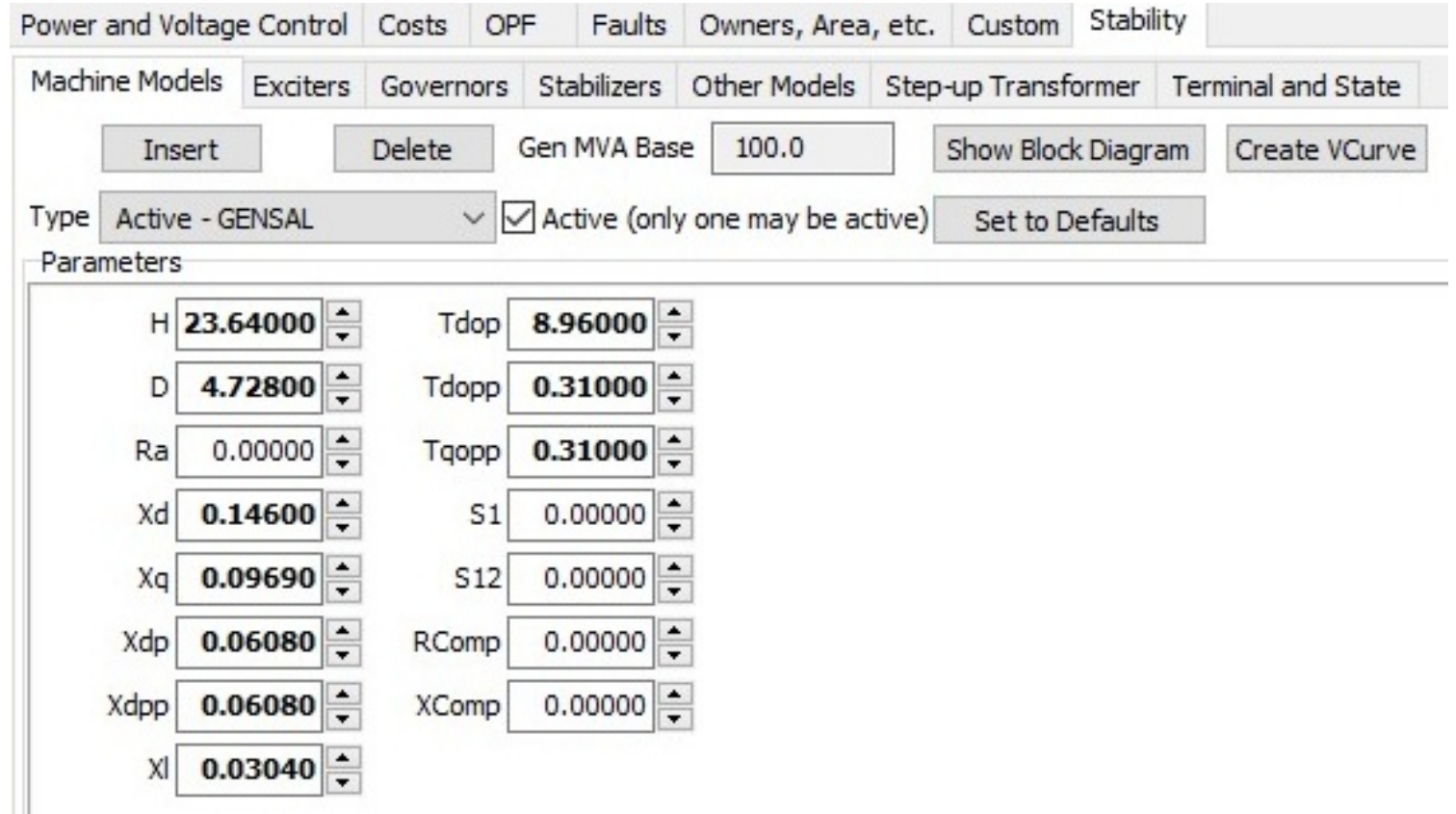
OK Save Save to Aux Cancel Help Print

Default parameters are present



Inserting a Model

- Modify the machine parameters at Bus 1 to match those shown here



The screenshot shows a software interface for configuring a machine model. The top navigation bar includes tabs for Power and Voltage Control, Costs, OPF, Faults, Owners, Area, etc., Custom, and Stability. Below this, there are sub-tabs for Machine Models, Exciters, Governors, Stabilizers, Other Models, Step-up Transformer, and Terminal and State. The 'Machine Models' tab is active, showing an 'Insert' button, a 'Delete' button, a 'Gen MVA Base' field set to 100.0, a 'Show Block Diagram' button, and a 'Create VCurve' button. The 'Type' dropdown is set to 'Active - GENSAI', and the 'Active (only one may be active)' checkbox is checked. A 'Set to Defaults' button is also present. The 'Parameters' section contains the following values:

H	23.64000	Tdop	8.96000
D	4.72800	Tdopp	0.31000
Ra	0.00000	Tqopp	0.31000
Xd	0.14600	S1	0.00000
Xq	0.09690	S12	0.00000
Xdp	0.06080	RComp	0.00000
Xdpp	0.06080	XComp	0.00000
Xl	0.03040		



Inserting a Model

- Repeat for Generators 2 and 3

Generator Information for Present

Bus Number: 2 Find By Number

Bus Name: Bus 2 Find By Name

ID: 1 Find ...

Area Name: 1 (1)

Labels ...: no labels

Generator MVA Base: 100.00

Power and Voltage Control Costs OPF Faults Owners, Are

Machine Models Exciters Governors Stabilizers Other Models

Insert Delete Gen MVA Base 100.0

Type: Active - GENSAL Active (only one may be a

Parameters

H	6.40000	Tdop	6.00000
D	1.28000	Tdopp	0.53500
Ra	0.00000	Tqopp	0.53500
Xd	0.89580	S1	0.00000
Xq	0.86450	S12	0.00000
Xdp	0.11980	RComp	0.00000
Xdpp	0.11980	XComp	0.00000
Xl	0.05990		

Generator Information for Present

Bus Number: 3 Find By Number

Bus Name: Bus 3 Find By Name

ID: 1 Find ...

Area Name: 1 (1)

Labels ...: no labels

Generator MVA Base: 100.00

Power and Voltage Control Costs OPF Faults Owners, Are

Machine Models Exciters Governors Stabilizers Other Models

Insert Delete Gen MVA Base 100.0

Type: Active - GENSAL Active (only one may be a

Parameters

H	3.01000	Tdop	5.89000
D	0.60200	Tdopp	0.60000
Ra	0.00000	Tqopp	0.60000
Xd	1.31250	S1	0.00000
Xq	1.25780	S12	0.00000
Xdp	0.18130	RComp	0.00000
Xdpp	0.18130	XComp	0.00000
Xl	0.09060		



Model Explorer – Machine Models



The screenshot shows the 'Model Explorer: Generator Machine Models' window. The main table displays parameters for three GENSAL machine models. An orange box highlights a section of the table, and a callout box points to a specific row.

Number of Bus	ID	Name_Nominal kV of Bus	Area Name of Gen	Type	MVA Base	Device Status	Sub-Int Used	H	D	Ra	Xd	Xq	Xdp	Xdpp
1	1	Bus1_16.50	1	GENSAL	100	Active		23.64	4.728	0	0.146	0.0969	0.0608	0.0608
2	2	Bus_2_18.00	1	GENSAL	100	Active		6.4	1.28	0	0.8958	0.8645	0.1198	0.1198
3	3	Bus_3_13.80	1	GENSAL	100	Active		3.01	0.602	0	1.3125	1.2578	0.1813	0.1813

H	D	Ra	Xd	Xq	Xdp	Xdpp	XI	Tdop	Tdopp	Tqopp	S1	S12	RComp	XComp
23.64	4.728	0	0.146	0.0969	0.0608	0.0608	0.0304	8.96	0.31	0.31	0	0	0	0
6.4	1.28	0	0.8958	0.8645	0.1198	0.1198	0.0599	6	0.535	0.535	0	0	0	0
3.01	0.602	0	1.3125	1.2578	0.1813	0.1813	0.0906	5.89	0.6	0.6	0	0	0	0

Can verify or change parameters here

Adding a Generator Exciter



- The purpose of the generator excitation system (exciter) is to adjust the generator field current to maintain a constant terminal voltage.
- PowerWorld Simulator includes many different types of exciter models. One simple exciter is the IEEET1. To add this exciter to the generator dialog, “Stability” tab, “Exciters” page. Click Insert and then select IEEET1 from the list.
- The IEEET1 is by far the most common exciter used in the 2006 MMWG case; the next most common is its close relative, the IEEEX1.

Insert Exciter Models



Add IEEE1 Exciter models to all three generators

Change settings for all three exciters to match these

Generator Information for Present

Bus Number: 1 | Find By Number

Bus Name: Bus1 | Find By Name

ID: 1 | Find ...

Area Name: 1 (1)

Labels ...: no labels

Generator MVA Base: 100.00

Status: Open, Closed

Energized: NO (Offline), YES (Online)

Fuel Type: UN (Unknown) | [PW=0] [EPC=0]

Unit Type: UN (Unknown) | [PW=0] [EPC=0]

Machine Models: Exciters | Governors | Stabilizers | Other Models | Step-up Transformer | Terminal and State

Insert | Delete | Gen MVA Base: 100.0 | Show Block Diagram | Create VCurve

Type: Active - IEEE1 | Active (only one may be active) | Set to Defaults

Parameters:

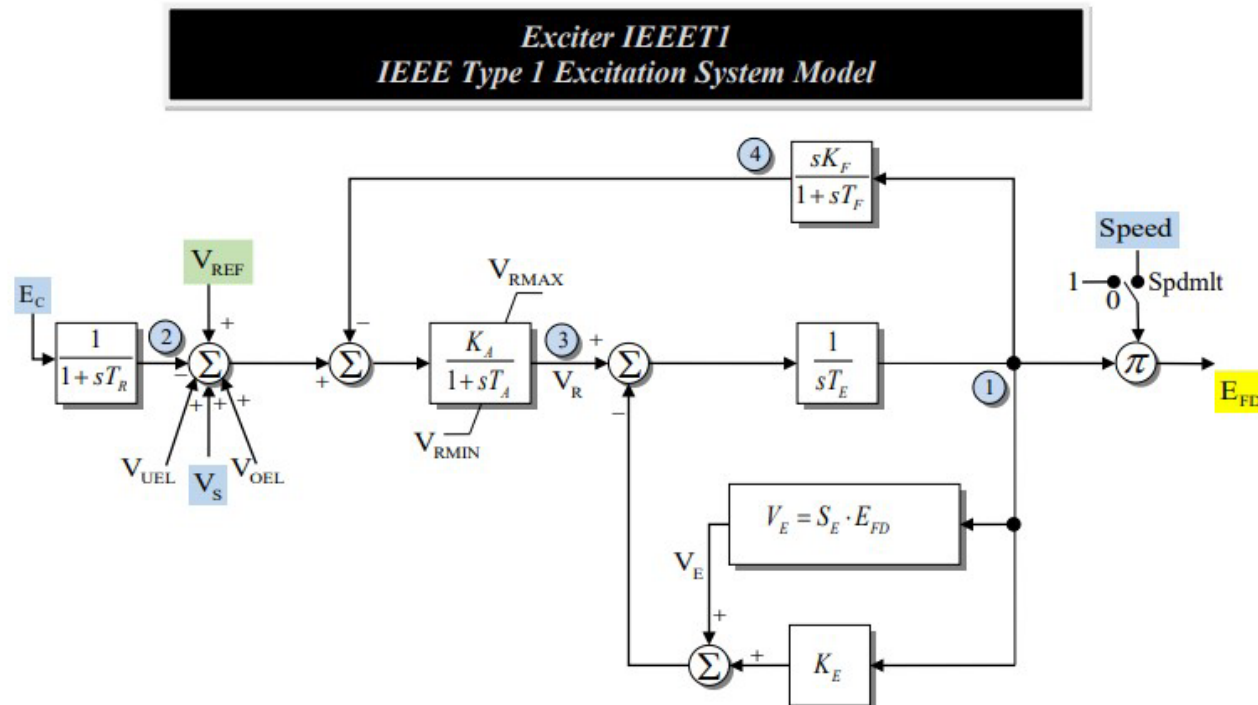
Tr	0.00000	Tf	0.35000
Ka	20.00000	Switch	0.00000
Ta	0.20000	E1	2.80000
Vrmax	3.00000	SE1	0.30340
Vrmin	-3.00000	E2	3.73000
Ke	1.00000	SE2	1.28840
Te	0.31400	Spdmlt	0.00000
Kf	0.06300		

Click to show block diagram

IEEET1 Exciter



- You can view the block diagram for the IEEET1 exciter by clicking on the “Show Diagram” button.
- This opens a PDF file in Adobe Reader to the page with the appropriate block diagram (shown below).



The input to the exciter, E_C , is usually the terminal voltage. The output, E_{FD} , is the machine field voltage.

Model Explorer - Exciters



Model Explorer: Generator Exciters

Explore Fields

- Voltage Droop Control
- VSC DC Transmission
- Aggregations
- Areas
- Balancing Authorities
- Bus Pairs
- Data Maintainers
- Injection Groups
- Interfaces
- Islands
- Multi-Section Lines
- MW Transactions
- Nomograms
- Owners
- Substations
- Super Areas
- Tielines between Areas
- Tielines between Buses
- Tielines between Zones
- Transfer Directions
- Zones
- Solution Details
- Case Information and Analysis
- Contingency Analysis
- Optimal Power Flow
- Tools and Add Ons
- Transient Stability
- DC Models
- Summary

Generator Exciters | Machine Models | Load Relays | Generator Other Models | Buses | Load Characteristics | Load Distributed Gen Models | Lin

Filter: Advanced | Exciter: IEEE11 | Find... Remove Quick Filter

Exciter: IEEE11 (3)

Number of Bus	ID	Name_Nominal kV of Bus	Area Name of Gen	Type	MVA Base	Device Status	Sub-In Used	Tr	Ka	Ta	Vrmax	Vrmin	Ke	Te	Kf	Tf	Switch	E1	SE1
1	1	Bus1_16.50	1	IEEE11	100	Active		0	20	0.2	3	-3	1	0.314	0.063	0.35	0	2.8	0.3034
2	1	Bus_2_18.00	1	IEEE11	100	Active		0	20	0.2	3	-3	1	0.314	0.063	0.35	0	2.8	0.3034
3	1	Bus_3_13.80	1	IEEE11	100	Active		0	20	0.2	3	-3	1	0.314	0.063	0.35	0	2.8	0.3034

Show Block Diagram

Tr	Ka	Ta	Vrmax	Vrmin	Ke	Te	Kf	Tf	Switch	E1	SE1	E2	SE2	Spdmlt
0	20	0.2	3	-3	1	0.314	0.063	0.35	0	2.8	0.3034	3.73	1.2884	0
0	20	0.2	3	-3	1	0.314	0.063	0.35	0	2.8	0.3034	3.73	1.2884	0
0	20	0.2	3	-3	1	0.314	0.063	0.35	0	2.8	0.3034	3.73	1.2884	0

Show Models Supported By

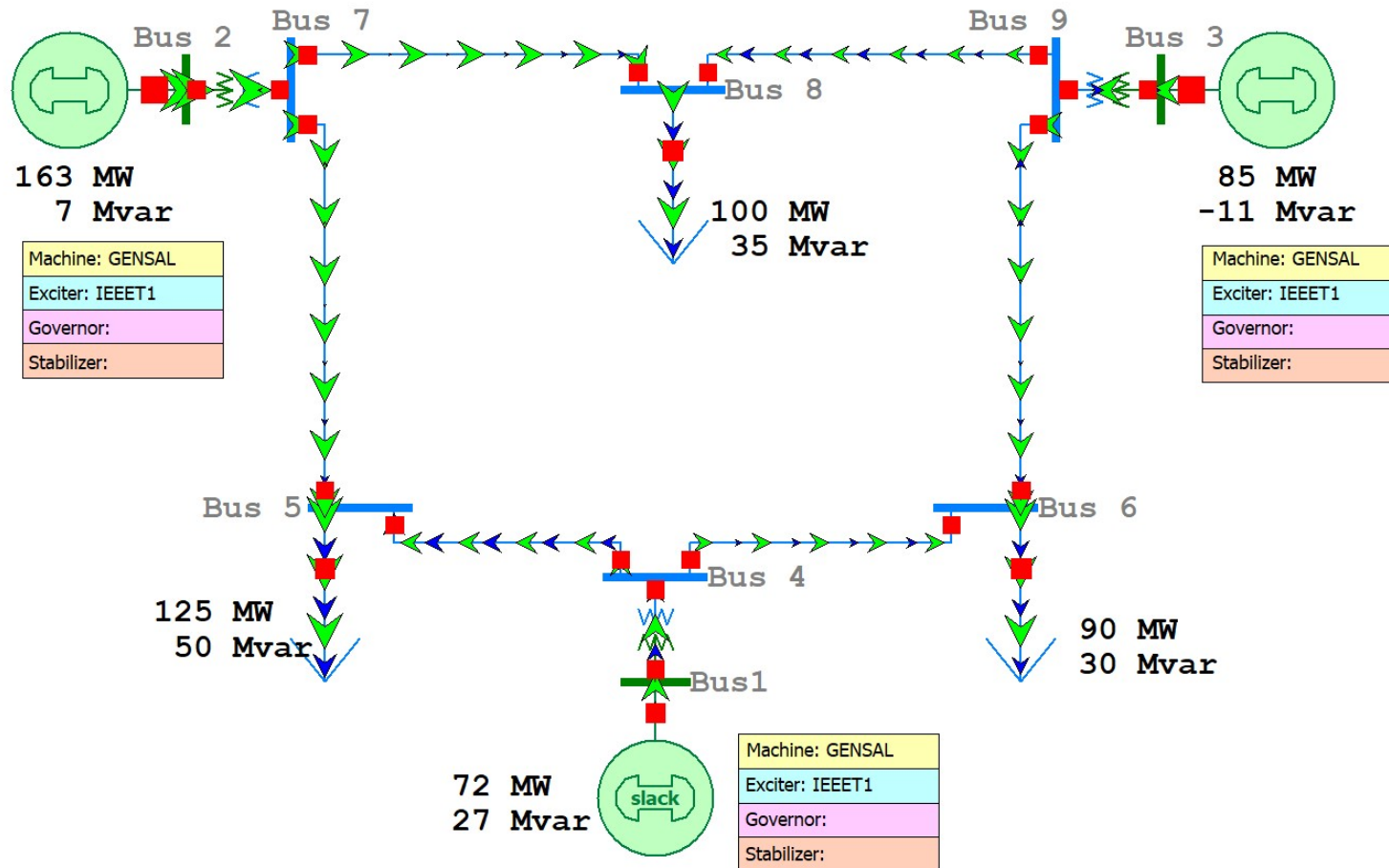
- PW Only
- PTI
- BPA
- GE
- Only Show Used Models

Save Load

Search Search Now Options

Can verify or change parameters here

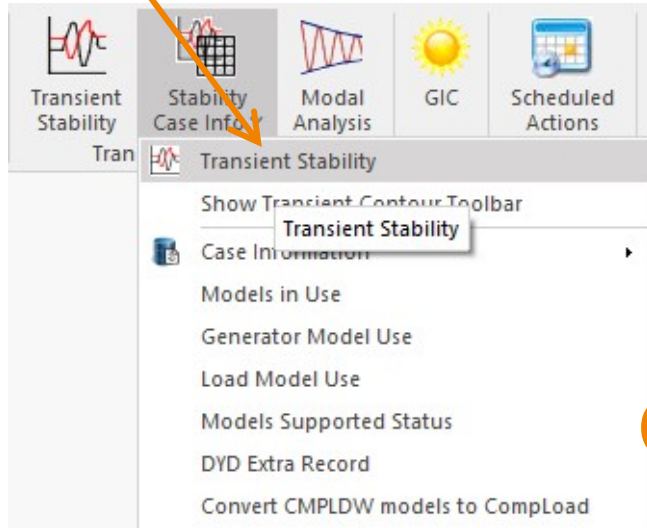
TS9Bus System with Machine and Exciter Models



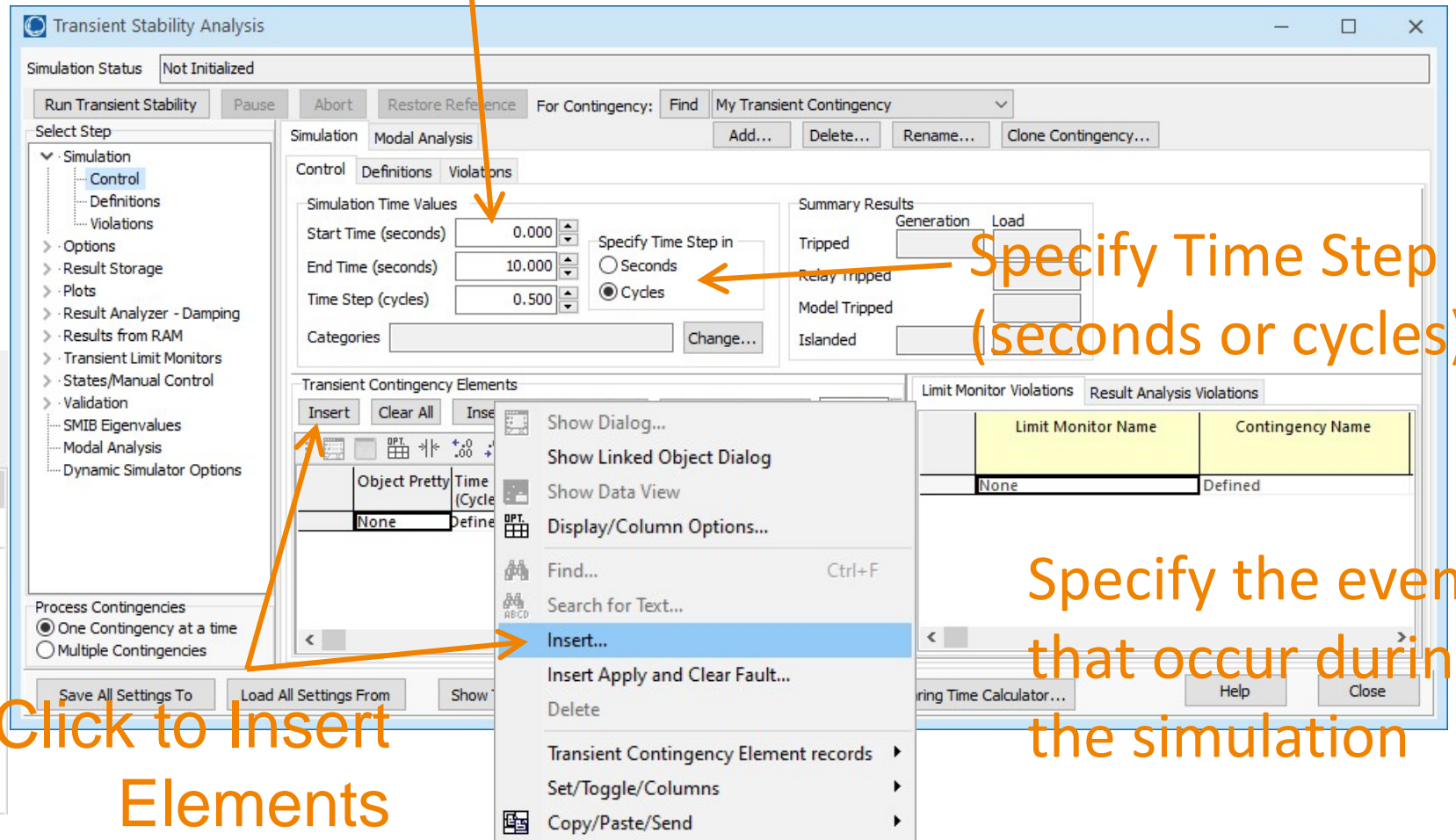


Define a Transient Contingency

Go to the **Add Ons** ribbon tab and select **Transient Stability**



Specify Start and End Time



Specify Time Step (seconds or cycles)

Click to Insert Elements

Specify the events that occur during the simulation

Transient Stability Contingency Element Dialog



- Clicking “Insert” opens the Transient Stability Contingency Element Dialog shown below
- This dialog is used to specify transient stability events and when they occur

No events have been defined yet

Object Type

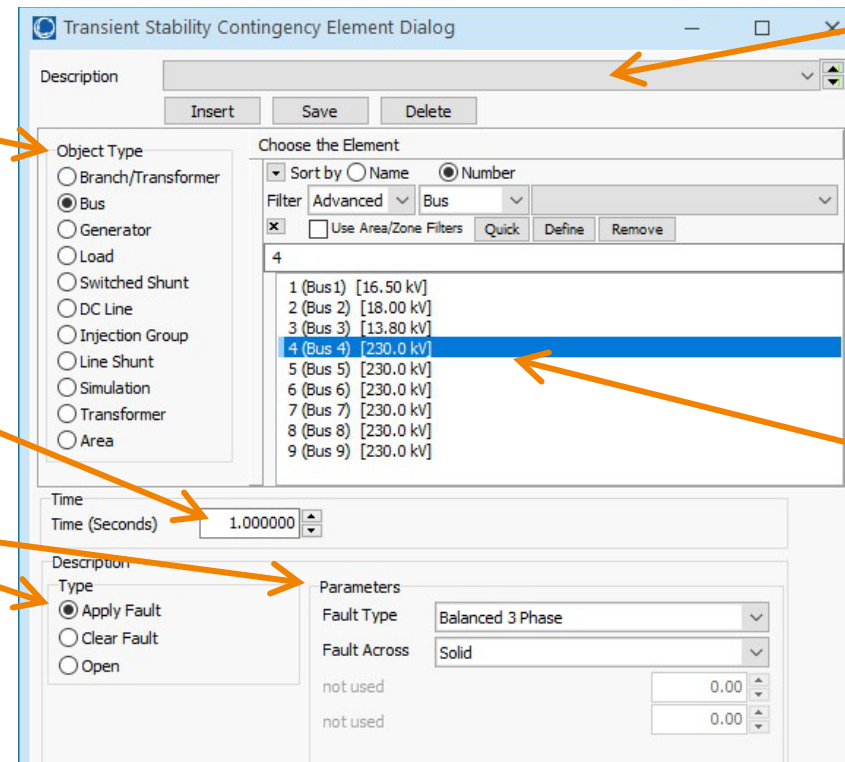
- Changes the type of events that can occur

Time

- When the event occurs

Event Type and Parameters

- Depends on Object Type



Description

- A drop-down list of all currently defined events
- May be used to switch between events and modify them as necessary
- Appears once the event is saved

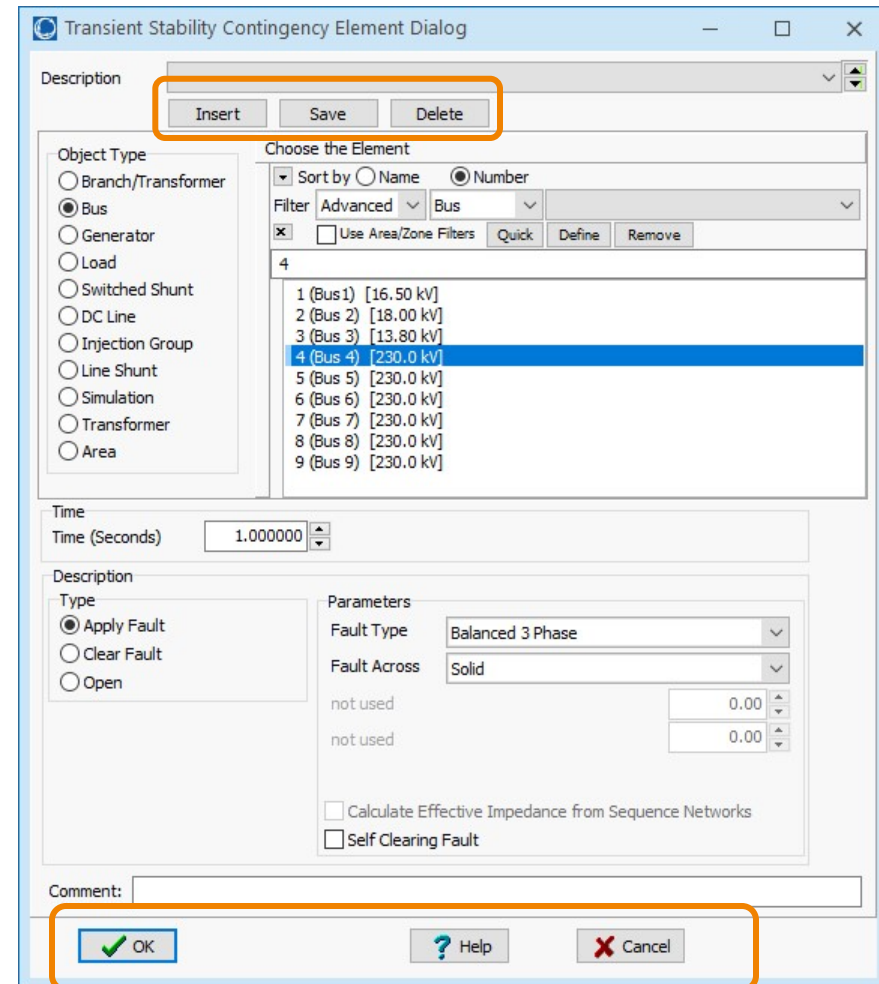
Choose the Element

- Apply the event to this element
- List is updated as Object Type is changed

Transient Stability Contingency Element Dialog

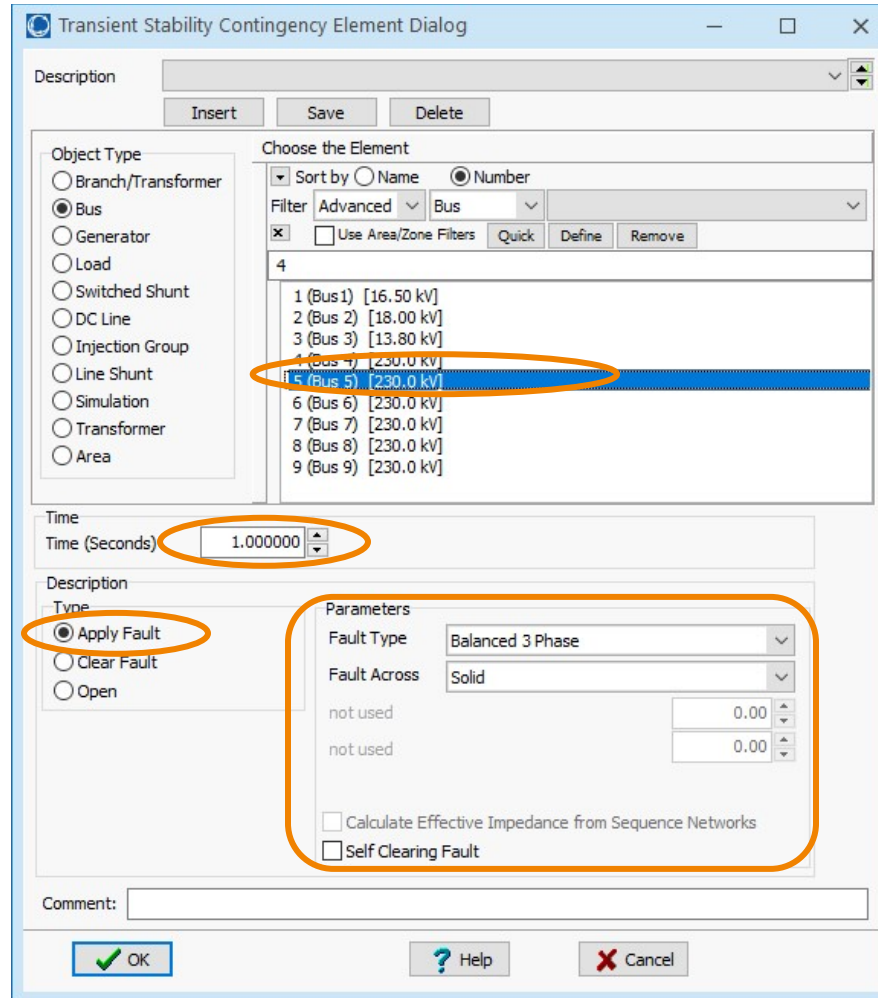


- “Save” will save any modifications but leave the dialog open
- “Insert” creates a new event with the specified parameters
- “OK” will accept changes and close the dialog
- “Delete” will delete the event defined by the event Description
- “Cancel” closes the dialog without saving



Add a Fault at Bus 5

- Apply a balanced solid three-phase fault on Bus 5 at time = 1.00 seconds



Clear Fault at Bus 5

- Clear the Bus 5 fault at time = 1.10 seconds

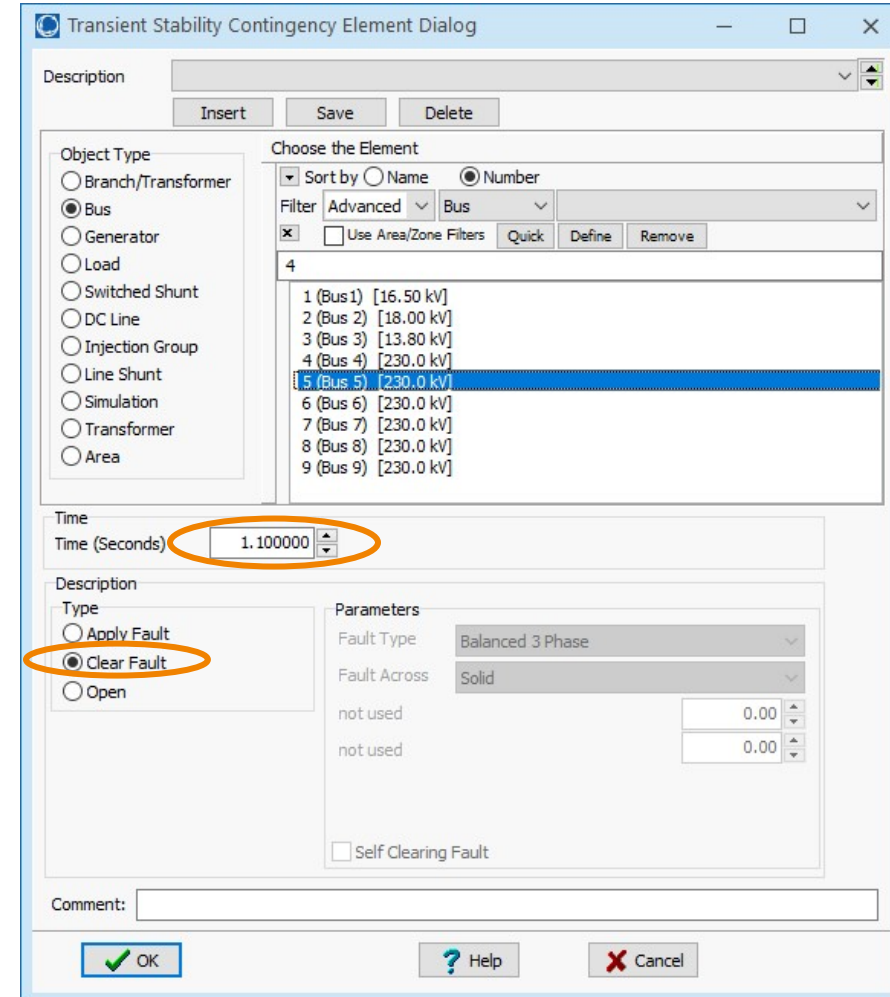
Note: could have also used the **Insert Apply/Clear/Open** button

Transient Contingency Elements

Insert

Clear All

Insert Apply/Clear/Open



Transient Contingency Definition



Summary of all elements in contingency and time of action

Simulation Status: Not Initialized

Simulation Time Values:
 Start Time (seconds): 0.000
 End Time (seconds): 10.000
 Time Step (cycles): 0.500

Object	Time (Cycles)	Time (Seconds)	Enabled	Object	Description
1 Bus Bus 5	60.0	1.000000	CHECK	Bus '5'	FAULT 3P
2 Bus Bus 5	66.0	1.100000	CHECK	Bus '5'	CLEARFA

Transient Contingency Element Dialog:
 Description: 1.100: [Bus Bus 5] CLEARFAULT
 Object Type: Bus
 Time (Seconds): 1.100000
 Description Type: Clear Fault
 Parameters: Fault Type: Balanced 3 Phase, Fault Across: Solid

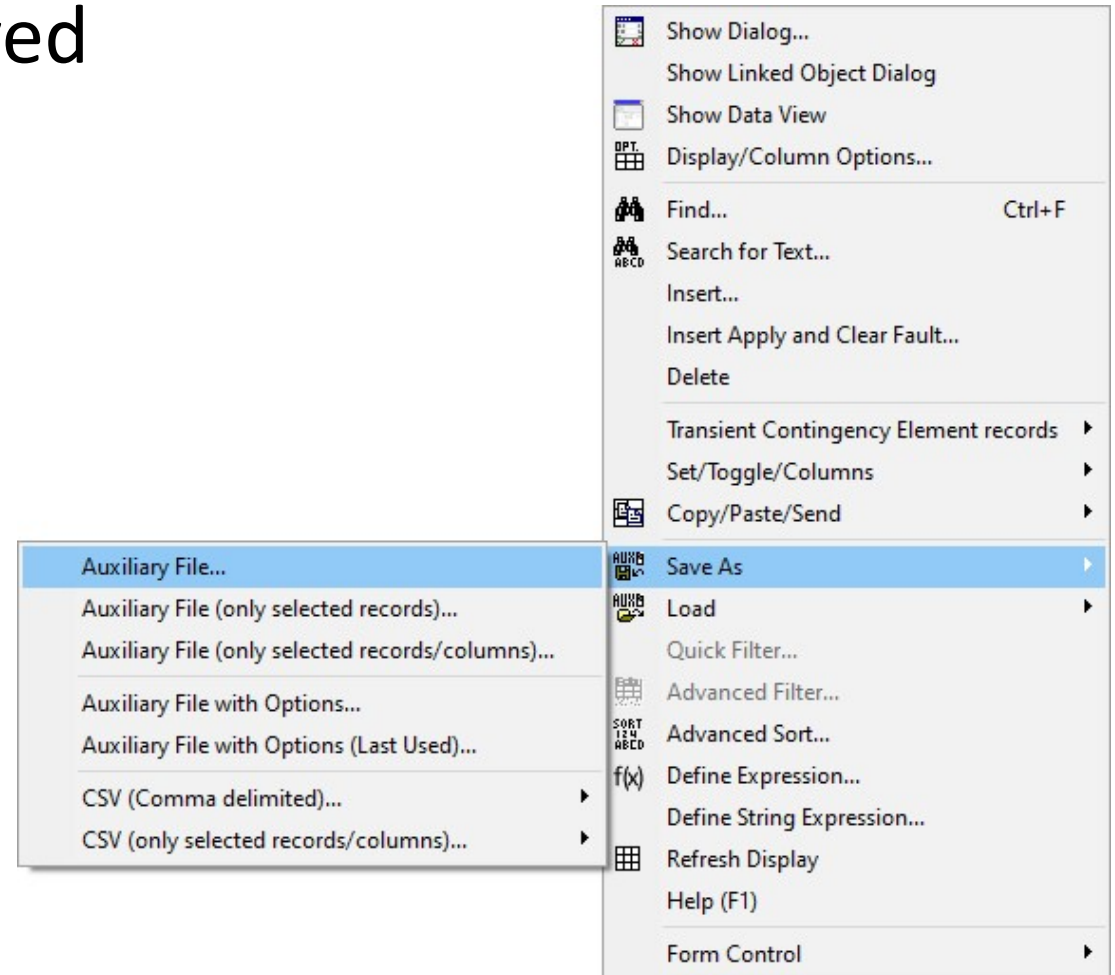
Right click here and select "show dialog" to reopen this dialog box

Available element types vary with different objects

AUX files to Save/Load Model Data



- Any of the model data can be saved into AUX files
- Save machine model data-
 - Right click in Model Explorer
 - Select “Save As” “Auxiliary File...”
- This data can be loaded back in



Save Stability Settings



Transient Stability Analysis

Simulation Status: Not Initialized

Run Transient Stability | Pause | Abort | Restore Reference | For Contingency: Find | My Transient Contingency

Select Step

- Simulation
 - Control
 - Definitions
 - Violations
 - Options
 - Result Storage
 - Plots
 - Result Analyzer - Damping
 - Results from RAM
 - Transient Limit Monitors
 - States/Manual Control
 - Validation
 - SMIB Eigenvalues
 - Modal Analysis
 - Dynamic Simulator Options

Process Contingencies

One Contingency at a time
 Multiple Contingencies

Simulation

Control | Definitions | Violations

Simulation Time Values

Start Time (seconds): 0.000
End Time (seconds): 10.000
Time Step (cycles): 0.500

Specify Time Step in:
 Seconds
 Cycles

Summary Results

	Generation	Load
Tripped		
Relay Tripped		
Model Tripped		
Islanded		

Transient Contingency Elements

Insert | Clear All | Insert Apply/Clear/Open | Time Shift (seconds): 0.000

	Object	Pretty	Time (Cycles)	Time (Seconds)	Enabled	Object	Description	Model Crit
1	Bus	Bus 5	60.0	1.000000	CHECK	Bus '5'	FAULT 3PB SOLID	
2	Bus	Bus 5	66.0	1.100000	CHECK	Bus '5'	CLEARFAULT	

Limit Monitor Violations | Result Analysis Violations

Limit Monitor Name	Contingency Name
None	Defined

Save All Settings To | Load All Settings From | Show Transient Contour Toolbar | Auto Insert... | Critical Clearing Time Calculator... | Help | Close

Save Data With Options...

Save Auxiliary...

Save GE DYD...

Save PTI DYR...

Save BPA SWI...

Only Records Modified in Difference Case >

Can save transient stability settings from here

Save Stability Data for Selected Mod... X

There are several settings which affect the Transient Stability calculations. Choose which settings you would like to save.

- Save Transient Stability Contingencies
- Save Transient Limit Monitors
- Save Transient Stability Options
- Save Results to Save
- Save Plot Definitions
- Save Dynamic Models
- Save Result Analyzer Time Windows

Save Data Using

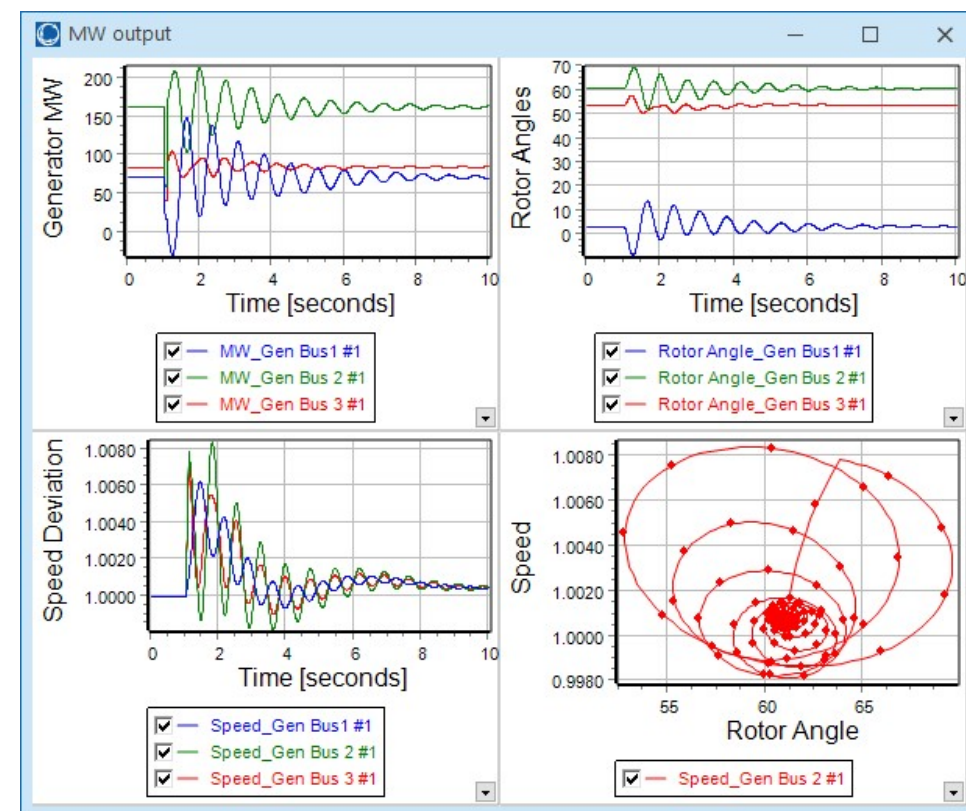
- Number (Primary Key)
- Name and Nominal kV (Secondary Key)
- Label (Use Primary if no label)

OK Cancel

Load in Plot Settings



- The machine models and exciter models for this example can also be loaded in from **TS9ExciterModels.aux** and **TS9MachModels.aux**
- Save the case with the models and events as **TS9Bus Bus Fault NoPlot**
- Go to Stability Case Info, Load Transient Stability Data, Load Auxiliary
- Load in the AUX file **TS9Bus Bus FaultPLOTDEFN.aux** which contains some plot settings that we will talk about in detail in a later section
- Save the case as **TS9BusCtgEx**
- Click “Run Transient Stability” to simulate the models and the events that you inserted



Example: Changing Contingency Elements

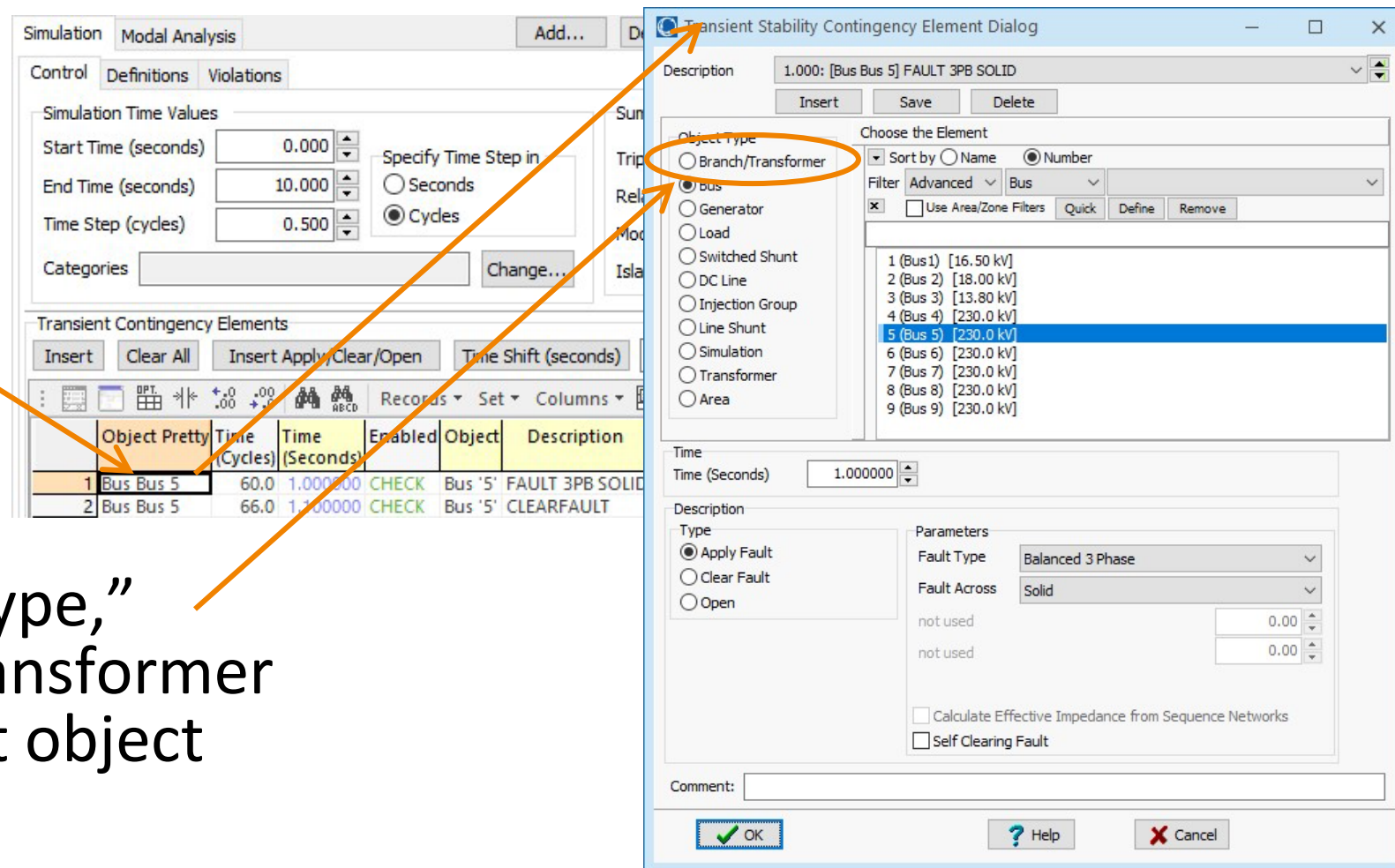


- Suppose you want to change the events that are simulated for a particular contingency
- We will change the elements of this Transient Contingency from a bus fault at Bus 5 to a fault between Bus 4 and Bus 5 near bus 5
- There are several ways this can be done
 - On the Simulation page, clicking “Clear All Elements” will remove the existing elements; you can then add new ones
 - You can right-click on an existing element and open the Transient Contingency Element Dialog and change the events directly

Example: Changing Contingency Elements

Right-click on the first Transient Contingency Element and open the Transient Stability Contingency Element dialog

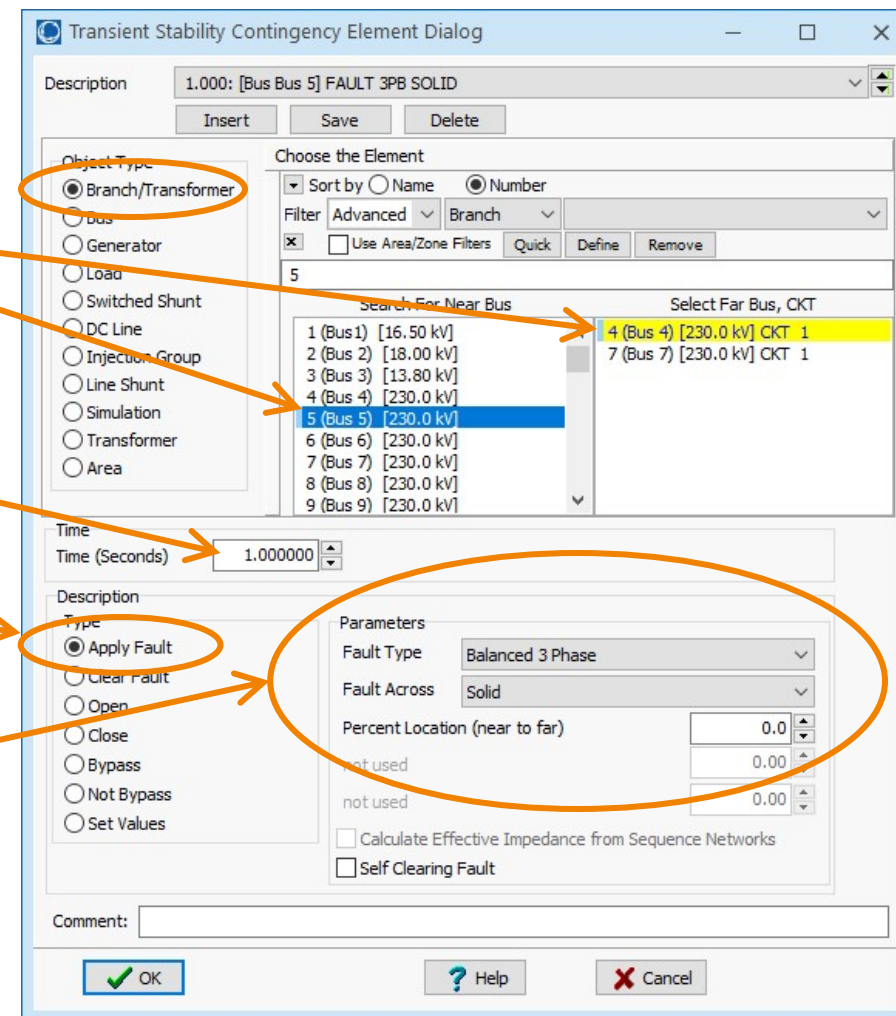
First, change "Object Type," from Bus to Branch/Transformer to view choices for that object type





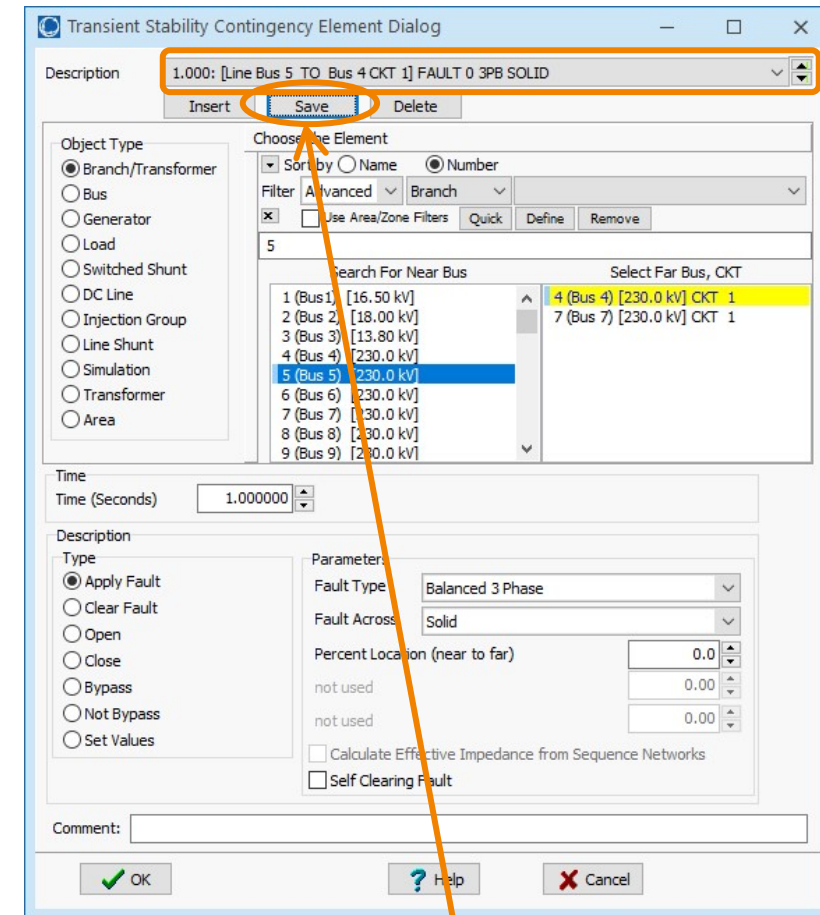
Example: Changing Contingency Elements

- “Choose the Element”
 - Make sure the Near Bus is selected to be 5 and Far Bus is selected to be 4
- “Time”
 - Time (Seconds) – set to 1.00
- “Description”
 - “Apply Fault” should be selected
- “Parameters”
 - Fault Type – set to Balanced 3 Phase
 - Fault Across – set to Solid
 - Percent Location (near to far) – set to 0.00



Example: Changing Contingency Elements

- After verifying these changes, click “Save”
- Once you click save, the Description at the top changes to reflect that this is now a branch fault
- Then, click OK to close the dialog
- Now the first Transient Contingency Element in the case information display has changed



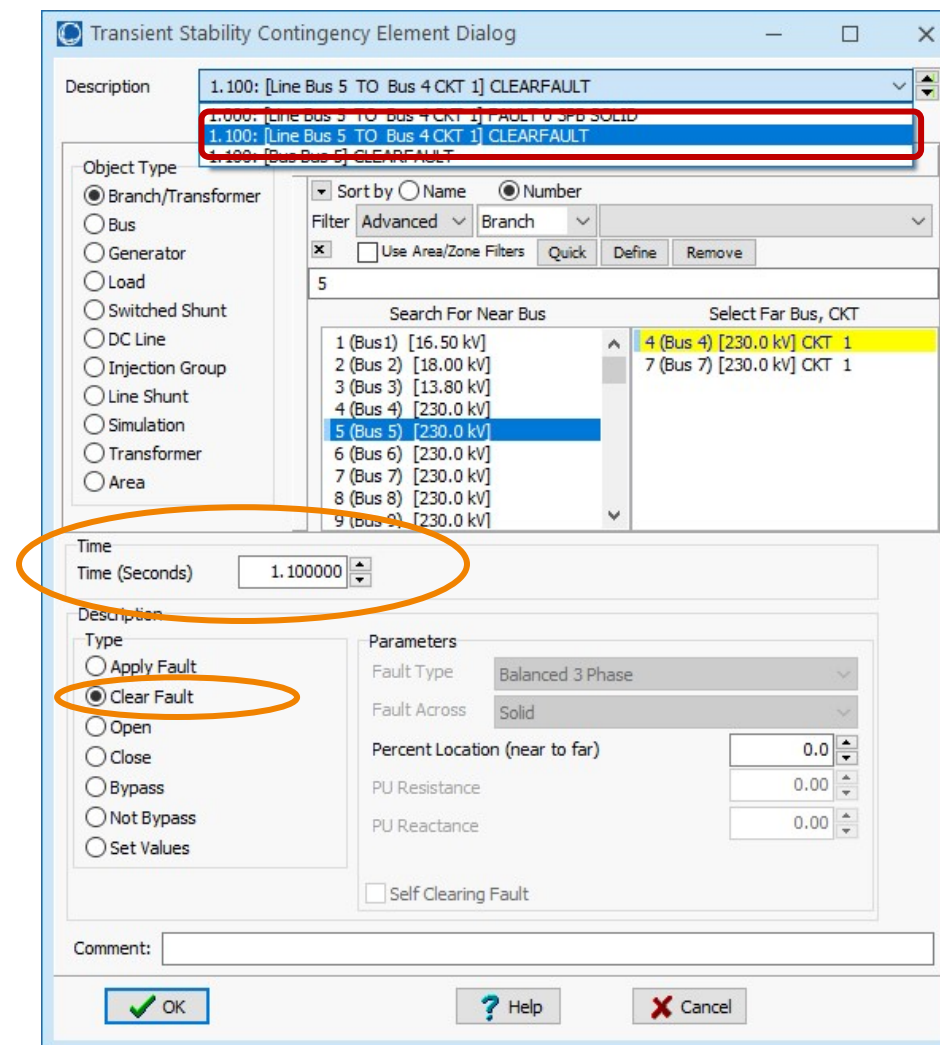
Transient Contingency Elements

Object Pretty	Time (Cycles)	Time (Seconds)	Enabled	Object	Description	Contingency Name
1 Line Bus 5 TO Bus 4 CKT 1	60.0	1.000000	CHECK	Branch '5' '4' '1'	FAULT 0 3PB SOLID	My Transient Contingency
2 Bus Bus 5	66.0	1.100000	CHECK	Bus '5'	CLEARFAULT	My Transient Contingency

After clicking “Save,” the Description and Case Information Displays will update

Example: Changing Contingency Elements

- Right-click on the second Transient Contingency Element and open the Transient Stability Contingency Element dialog
- From the Description drop-down menu, select the description for the element that you just created
- Change the time to 1.1
- Change Apply Fault to Clear Fault
- All other parameters are unchanged
- Click Insert – a new contingency element with a new name has been created





Example: Changing Contingency Elements

Transient Contingency Elements

Insert Clear All Insert Apply/Clear/Open Time Shift (seconds) 0.000

	Object Pretty	Time (Cycles)	Time (Seconds)	Enabled	Object	Description	Contingency Name
1	Line Bus 5 TO Bus 4 CKT 1	60.0	1.000000	CHECK	Branch '5' '4' '1'	FAULT 0 3PB SOLID	My Transient Contingency
2	Line Bus 5 TO Bus 4 CKT 1	66.0	1.100000	CHECK	Branch '5' '4' '1'	CLEARFAULT	My Transient Contingency
3	Bus Bus 5						My Transient Contingency

Settings From Sh

Find... Ctrl+F

Search for Text...

Insert...

Insert Apply and Clear Fault...

Delete

Transient Contingency Element records >

Set/Toggle/Columns >

Copy/Paste/Send >

Save As >

- Click OK to close the dialog
- We still need to delete the third Transient Contingency Element which had been used previously for clearing the Bus 5 fault

Right-click and choose "Delete"

Confirm the decision to delete the record

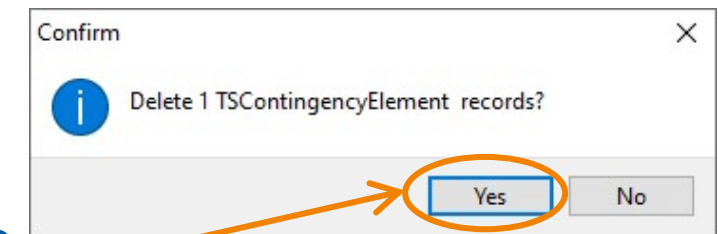


Table showing the new Transient Contingency Elements

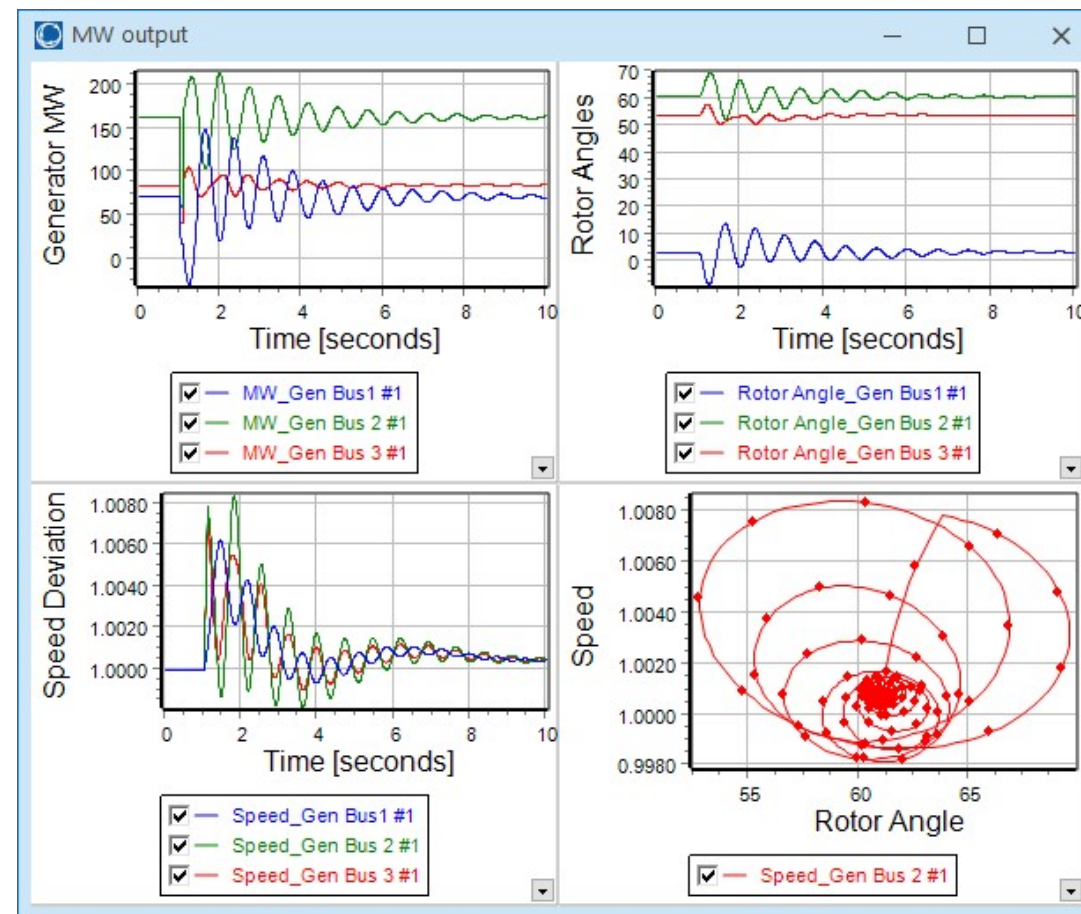
Transient Contingency Elements

Insert Clear All Insert Apply/Clear/Open Time Shift (seconds) 0.000

	Object Pretty	Time (Cycles)	Time (Seconds)	Enabled	Object	Description	Contingency Name
1	Line Bus 5 TO Bus 4 CKT 1	60.0	1.000000	CHECK	Branch '5' '4' '1'	FAULT 0 3PB SOLID	My Transient Contingency
2	Line Bus 5 TO Bus 4 CKT 1	66.0	1.100000	CHECK	Branch '5' '4' '1'	CLEARFAULT	My Transient Contingency

Example: Changing Contingency Elements

- The new events may also be loaded from **TS9ChangeCtg.aux**
- You have now changed what events will be simulated for this Transient Contingency
- Click “Run Transient Stability” to re-run the simulation to simulate a branch fault between Buses 4 and 5 fault located near Bus 5
- The plots should look the same as when you simulated this as a bus fault



Multiple Contingencies



- In most of the training, we just talk about simulating a single transient contingency event
- Simulator facilitates the definition of multiple transient contingency scenarios within the same case
- These Multiple Transient Contingencies may be defined and simulated, either individually or all together
- Changing the Process Contingencies option from “One Contingency at a time” to “Multiple Contingencies” will change the dialog in small ways throughout
- This will be discussed later

Slide Intentionally Left Blank

Slide Intentionally Left Blank

Slide Intentionally Left Blank